the dislocation of those rings, and to determine its peculiar character, as indicated by the direction in which the dislocation takes place; the protrusion of the alternate quadrants appearing, in certain cases, in one direction, and in others in the opposite. These observations are reducible to two classes; first, those designed to contribute to the inquiry, what substances possess the property of elliptic polarization, by examining the light reflected from various bodies; and second, those made on certain cases of films of several kinds, including those formed on metals by oxidation or other action upon the metal itself, as well as by extraneous deposition. The author found the general result, in all these cases, to be, that from any one tint to another, through each entire order of tints, the form of the rings in the reflected light undergoes certain regular changes; passing from a dislocation in one direction to that in the opposite, through an intermediate point of no dislocation, or of plane polarization; and thus exhibiting a dark and a bright centred system alternately, as long as the order of tints are preserved pure. These changes in the form of the rings, he observes, are precisely those expressed by successive modifications of Mr. Airy's formula, corresponding to the increments in the retardation which belong to the periodical colours of the films.

The remaining portion of the paper is occupied by a description of the apparatus and mode of conducting the experiments; and of the observations made on mica, on decomposed glass, plumbago, daguerreotype, and other metallic plates, and on the coloured films produced on steel and on copper by the action of heat, and of voltaic electricity. The author gives, in conclusion, an analytical investigation of Mr. Airy's general formula.

2. "Variation of the Magnetic Needle as observed at Washington City, D. C., from $3^h\ 30^m$ July 24th to 3^h July 25th, 1840, inclusive (Göttingen mean time)," by Lieut. Gillies, of the United States Service. Communicated by Samuel Hunter Christie, Esq., Sec. R.S.

February 2, 1843.

Sir JOHN WILLIAM LUBBOCK, Bart., V.P. and Treasurer, in the Chair, succeeded by the MARQUIS OF NORTHAMPTON, the President, in the Chair.

John Benjamin Heath, Esq., James MacCullagh, Esq., and George Owen Rees, M.D., were balloted for and duly elected Fellows of the Society.

A paper was read, entitled "Experimental Researches in Electricity:" Eighteenth Series; by Michael Faraday, Esq., D.C.L., F.R.S. Section 25. On the Electricity evolved by the Friction of Water and Steam against other bodies.

The object of the experiments related in this paper, is to trace the source of the electricity which accompanies the issue of steam of high pressure from the vessels in which it is contained. By means of a suitable apparatus, which the author describes and delineates, he found that electricity is never excited by the passage of pure steam, and is manifested only when water is at the same time present; and hence he concludes that it is altogether the effect of the friction of globules of water against the sides of the opening, or against the substances opposed to its passage, as the water is rapidly moved onwards by the current of steam. Accordingly it was found to be increased in quantity by increasing the pressure and impelling force of the steam. The immediate effect of this friction was, in all cases, to render the steam or water positive, and the solids, of whatever nature they might be, negative. In certain circumstances, however, as when a wire is placed in the current of steam at some distance from the orifice whence it has issued, the solid exhibits the positive electricity already acquired by the steam, and of which it is then merely the recipient and the conductor. In like manner, the results may be greatly modified by the shape, the nature, and the temperature of the passages through which the steam is forced. Heat, by preventing the condensation of the steam into water, likewise prevents the evolution of electricity, which again speedily appears by cooling the passages so as to restore the water which is necessary for the production of that effect. The phenomenon of the evolution of electricity in these circumstances is dependent also on the quality of the fluid in motion, more especially in relation to its conducting power. Water will not excite electricity unless it be pure; the addition to it of any soluble salt or acid, even in minute quantity, is sufficient to destroy this property. The addition of oil of turpentine, on the other hand, occasions the development of electricity of an opposite kind to that which is excited by water; and this the author explains by the particles or minute globules of the water having each received a coating of oil in the form of a thin film, so that the friction takes place only between that external film and the solids, along the surface of which the globules are carried. A similar, but a more permanent effect is produced by the presence of olive oil, which is not, like oil of turpentine, subject to rapid dissipation.

Similar results were obtained when a stream of compressed air was substituted for steam in these experiments. When moisture was present, the solid exhibited negative, and the stream of air positive electricity; but when the air was perfectly dry, no electricity of any kind was apparent. The author concludes with an account of some experiments in which dry powders of various kinds were placed in the current of air; the results differed according to the nature of the substances employed, and other circumstances.